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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 066466

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ELECTRONIC RESISTANCE SPOT WELDER (electronics) 6-98.027

B-584 or S-367

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EDUCATION & WELFARE
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TM 001 950

U. S. Employment Service
in Cooperation with
California State Employment Service

June 1964

GATB #2501

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ELECTRONIC RESISTANCE SPOT WELDER (electronics) 6-98.027

B-584

Summary

The General Aptitude Test Battery, B-1002B was administered to a final sample of 50 individuals employed as Electronic Resistance Spot Welders 6-98.027 at various companies in California. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G-Intelligence, S-Spatial Aptitude and K-Motor Coordination were selected for inclusion in the final test norms.

GATB Norms for Electronic Resistance Spot Welder (electronics) 6-98.027, B-584

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1- H CB-1- I CB-1- J	75	G	Part 3 Part 4 Part 6	70
S	CB-1- F CB-1- H	90	S	Part 3	85
T	CB-1- G CB-1- K	85	K	Part 8	80

Effectiveness of Norms

The data in Table IV indicate that only 66 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 80 percent would have been good workers. 34 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 20 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Electronic Resistance Spot Welder 6-98.027.

II. Sample

The General Aptitude Test Battery, B-1002B, was administered during the period December 1962 to January 1964 to 63 women and 1 man employed as Electronic Resistance Spot Welders at Alpha-Tronics, Monrovia; Lockheed Electronics, Maywood; Marshall Laboratories, Torrance; Northrup Corporation, Ventura; Space Technology Laboratories, Manhattan Beach; Walkirt Company, Los Angeles; and Wems Incorporated, Hawthorne, California. Fourteen women were eliminated from the sample due to the lack of experience required on the job. Thus, the final experimental sample consisted of 49 women and 1 man.

Entrance requirements for this job vary from plant to plant. All companies will hire inexperienced workers with a minimum age limit of 18. There are no set requirements for education. The training period consists of two weeks to three months on-the-job training. It was agreed by supervisors at each company that workers can be considered experienced workers after being on the job for three months. All of the above companies have experienced constant turnover in this occupation due to the lack of ability demonstrated by the Electronic Resistance Spot Welders to perform this operation. All workers in the sample perform comparable work and all are considered experienced workers.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

N = 50	M	σ	Range	r
Age (years)	28.8	8.1	19-48	.009
Education (years)	11.3	1.1	8-14	.063
Experience (months)	13.5	16.6	3-84	.320*

*Significant at the .05 level

III. Job Description

Job Title: Electronic Resistance Spot Welder (electronics) 6-98.027

Job Summary: Assembles and welds miniature modules and other electronic assemblies for use in aerospace, communication, digital, and other instrumentation systems, using such equipment as electric spot welder, miniature hole punch, and binocular microscope, and such handtools as scissors, long-nosed pliers, wire cutters, and tweezers.

Work Performed: Performs any of the following duties as assigned: Punches hole in wafer: Positions wafer, on which diagram is printed, on bed of hole punch. Looks in microscope, adjusting it for focus, and alines dots in diagram over pin-point light of punch. Depresses foot pedal that actuates punch and punches hole in wafer. Repeats process until all dots printed on diagram are punched. Trims wafer on printed lines, using scissors.

Loads module with components: Positions two perforated wafers in jig and puts jig in holder. Selects miniature components, such as capacitors, diodes, resistors, and transistors from bins, according to color code and code number on blueprint instructions and parts lists. Inserts component lead wires through punched holes on wafer, using tweezers and following blueprint drawings or assembly diagrams. Snips wire with wire cutters to facilitate threading wire through holes. Repeats process until all components are assembled. Cuts specified length of wire, and places it into position at weld point or circuit, according to blueprint instructions, to form module lead wires.

Welds interconnecting nickel ribbon to component lead wires: Trims lead wires to specifications, using wire cutters. Cuts nickel ribbon to length specified on diagram printed on wafer. Preforms ribbon, according to diagram, and positions ribbon between lead wires, insuring that ribbon is not shorting electrode, using tweezers. Examines module to insure that components are correctly positioned.. Obtains welding head specified on weld sequence chart, from set-up girl, and plugs in and locks head into power supply. Looks in microscope, adjusting it for focus and alines point to be welded between electrodes, following weld sequence chart. Depresses foot pedal to conduct current into electrode and weld ribbon to lead wire. May press button on console that controls voltage setting of electrodes, following assembly drawings.

Mounts and welds modules and components on matrix: Receives instructions and reads blueprint drawings and weld sequence charts to determine placement of modules on matrix. Mounts modules on matrix, inserting lead wires through mounting holes, following written instructions and printed diagram on matrix. Examines modules and components for correct position, type of module, value according to color code, and polarity. Trims wires to specifications, using wire cutters. Cuts nickel ribbon to length specified on printed diagram. Preforms ribbon, according to

diagram, and positions ribbon between leads, insuring that ribbon is not shorting electrode. Calls out number of welding head, according to weld sequence charts. Receives welding head, and plugs in and locks head into power supply. Looks in microscope, and alines point to be welded between electrodes, following weld sequence charts. Depresses foot pedal to conduct current into electrode and weld ribbon to wire. Repeats process until complete.

Inspects and cleans electrodes: Inspects electrodes under microscope to determine if they are discolored, pitted, or need cleaning or replacing. Cleans points of electrodes, using burnishing disk, or dressing tool. Removes electrodes that are bent or worn by unscrewing set screws with screwdriver. Inserts new electrodes in welding head and tightens screws. Checks length and angle of electrodes, using electrode alinement gage. Checks pound pressure and voltage of electrodes with pressure gage and voltmeter.

IV. Experimental Battery

All the tests of the GATB, B-1002B , were administered to the sample group.

V. Criterion

The criterion data collected consisted of two sets of independent ratings made by the first-line supervisor on USES Form SP-21, "Descriptive Rating Scale." The rating scale consisted of five items covering different aspects of job performance, with five alternatives for each item. Weights of one through five, indicating the degree of job proficiency attained, were assigned to the alternatives. A reliability coefficient of .82 was obtained for the criterion. Therefore, the two sets of ratings were combined, resulting in a distribution of final criterion scores of 20-48, with a mean of 30.8 and a standard deviation of 6.2.

VI Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Spatial Aptitude (S) - required to read and interpret blueprints, and to relate symbols found on diagrams and prints to physical components.

Form Perception (P) - required to perceive detail of diagram on wafer. Required to make visual comparisons of wires, ribbons, diodes, capacitors and other different electronic components in assembly and welding processes.

Motor Coordination (K) - required to coordinate eye and hand movements in the assembly procedure.

Finger Dexterity (F) and Manual Dexterity (M) - required in positioning small components and lead wires when building module using various hand tools.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 50

Aptitudes	M	σ	r
G-Intelligence	90.8	14.7	.337*
V-Verbal Aptitude	95.1	11.4	.362**
N-Numerical Aptitude	87.7	18.3	.251
S-Spatial Aptitude	96.7	16.9	.302*
P-Form Perception	107.7	18.6	.134
Q-Clerical Perception	106.2	16.6	.117
K-Motor Coordination	109.8	15.5	.295*
F-Finger Dexterity	109.3	17.7	.114
M-Manual Dexterity	117.3	19.6	.012

*Significant at the .05 level
**Significant at the .01 level

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important				X	X		X	X	X
Irrelevant									
Relatively High Mean							X	X	X
Relatively Low Sigma	X	X							
Significant Correlation with Criterion	X	X		X			X		
Aptitudes to be Considered for Trial Norms	G	V		S			K	F	M

Trial norms consisting of various combinations of Aptitudes G, V, S, K, F and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of G-70, S-85, and K-90 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes G, S and K with critical scores of 70, 85 and 90, respectively, and the dichotomized criterion for Electronic Resistance Spot Welder 6-98.027. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Norms for
Electronic Resistance Spot Welder 6-98.027
(G-70, S-85, K-90)

N = 50	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	24	33
Poor Workers	11	6	17
Total	20	30	50

Phi Coefficient = .36
χ^2 = 6.550
P/2 < .01

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, S and K with minimum scores of 70, 85 and 90, respectively, have been established as B-1002 norms for Electronic Resistance Spot Welder 6-98.027. The equivalent B-1001 norms consist of G-75, S-90 and T-85.

IX. Determination of Occupational Aptitude Pattern

The data for this study did not meet the requirements for incorporating the occupation studied into the January 1962 edition of Section II of the Guide to the Use of the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.